Pediatric Multiple Sclerosis

An Honors Thesis (HONR499)

by

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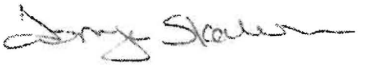

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Author's Statement

Multiple Sclerosis is a disease that the common population knows little about. It is my goal that after reading this, a person can be more educated on the disease. I was motivated to research Multiple Sclerosis after meeting an inspiring young man named Daniel Clevenger. His father, Jeff Clevenger, passed from Multiple Sclerosis soon before my freshman year began in 2009. Daniel started an Exercise Science Club 5k run walk in honor of Jeff. As an exercise science student and three-year club officer, I have gotten to know Daniel's family well, and raising awareness about Multiple Sclerosis has become an important part of my life. I am currently enrolled in a graduate program for physical therapy, and it is my goal to become a pediatric therapist. For this reason, my focus is in pediatric MS. I hope that my research can benefit those wanting to learn more about Multiple Sclerosis.

Abstract

Multiple Sclerosis is a chronic condition in which scars are formed on neurons in the central nervous system. This debilitating disease is growing ever more common in the United States. Although the disease manifests itself more often in adults, studies suggest that 2-5% of all cases of Multiple Sclerosis occur in children under the age of 18. The analysis of the disease of Multiple Sclerosis as well as three different types of treatment including physical and occupational therapy, alternative therapies, and medicinal therapies gives an idea of how what the disease is and how it plays a role in pediatrics.

Acknowledgements

I would like to the professor Tonya Skalon for advising me through this project. Her help during this difficult task is only a small part of the guidance she has given me through my four years of undergraduate study.

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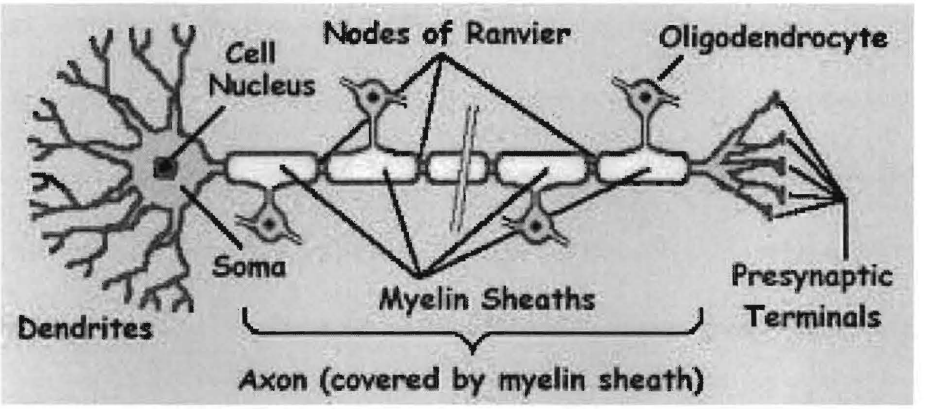
Introduction

Multiple Sclerosis, also referred to as MS, is a chronic condition in which scars called lesions are formed in the central nervous system. Although the disease manifests itself more in adults, studies suggest that 2-5% of all people with MS develop symptoms before the age of 18. Scientists and doctors believe that the disease is diagnosed less often in children simply because there are many diseases with similar symptoms that MS can be mistaken for ("Pediatric (Child) MS," n.d.). Currently, MS treatment in children is similar to that of adults simply because there is not enough research for the pediatric side of the disease. It is suggested, however, that children experience some symptoms that adults do not such as lethargy and seizures. The disease is also believed to progress more slowly in adolescents, however doctors and scientists have not discovered why the disease differs in children ("Pediatric (Child) MS," n.d.). In this paper I will utilize prior research to discuss what Multiple Sclerosis is, as well as three of the most common types of therapy used in treatment of the disease in pediatric cases: physical and occupational therapy, alternative therapies, and medicinal therapies.

About Multiple Sclerosis

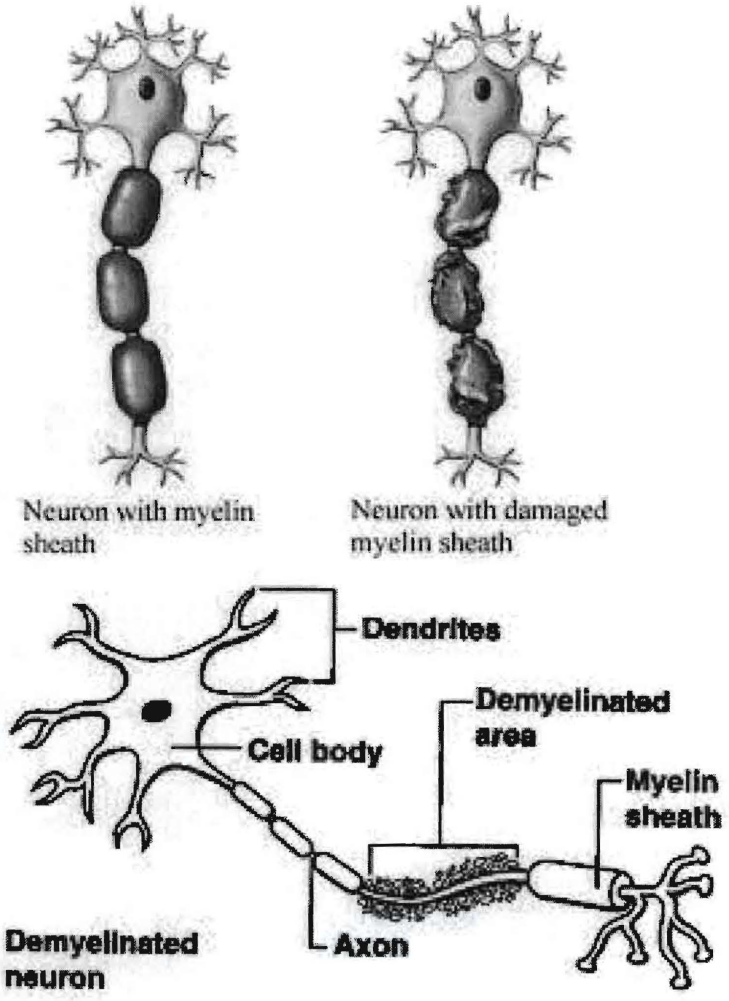
By definition, Multiple Sclerosis is a chronic autoimmune disorder affecting movement, ensation and bodily functions. It is caused by the destruction of the myelin insulation covering nerve fibers in the central nervous system thus leading to the creation of lesions on the neurons ("Multiple Sclerosis," n.d.). The process of

forming the lesions is referred to as sclerosis, so multiple sclerosis literally means many scars. In the central nervous system, thousands of nerve cells communicate by sending electrical signals to one another. The signals travel across the neuron's body known as the axon. For a normal neuron without MS, signals will jump between areas of myelin sheath, an electrically insulating material that helps to send signals more quickly and efficiently, along what are referred to as the Nodes of Ranvier ("Nodes of Ranvier," n.d.).



(This picture depicts a normal neuron. Signals are received at the dendrites; they then travel down the axon jumping from one Node of Ranvier to the next. Signals then enter the synaptic terminals and are sent on to the next neuron ("How Does Multiple Sclerosis," 2013).)

When a person develops MS, the myelin that protects the nerve cells is destroyed in a process known as demyelination. This process leads to a breakdown in important signal transmissions. When the signals break down, the nerves can be damaged thus causing permanent symptoms and disabilities.



(These two pictures illustrate the effects of demyelination caused by Multiple Sclerosis ("What is Multiple Sclerosis," 2013).)

Multiple Sclerosis occurs most commonly in people 15 to 60 years of age with a higher number of instances in the upper age range. Women are twice as likely to develop the disease as men, and it is estimated that nearly 400,000 United States citizens are sufferers of the disease with 8,000 to 10,000 of those being children under the age of 18 ("What is Multiple Sclerosis," n.d.).

Early symptoms of MS are muscle weakness, causing difficulty walking and moving; loss of coordination or balance; numbness or abnormal sensations and visual disturbances including blurred or double vision. As the disease progresses, patients may experience a number of other symptoms including fatigue, muscle spasticity and stiffness, tremors, paralysis, pain, vertigo, speech or swallowing difficulty, loss of bowel and bladder control, incontinence, sexual dysfunction and cognitive changes ("Multiple Sclerosis," n.d.). The symptoms of MS can occur in one of three patterns, "relapsing-remitting", "primary progressive" and "secondary progressive". The most common pattern of MS, and the one seen most often in pediatrics, is referred to as a "relapsing-remitting" pattern. At this stage, there are very clearly defined symptomatic attacks lasting for 24 hours or more, followed by complete or almost complete improvement. A symptomatic attack can be anything from muscle weakness to cognitive changes and paralysis ("Multiple Sclerosis," n.d.). The period between attacks is longer at the beginning of the disease. Patients may go for a year or more without symptoms; however, the intervals between attacks may shrink to several months as the disease progresses. A second pattern is known as the "primary-progressive" pattern. In this pattern, the disease will progress without remission or with occasional plateaus or slight improvements. This pattern is seen more in older adults. The final pattern seen in Multiple Sclerosis is the "secondary-progressive" pattern in which the patient begins with relapses and remissions, followed by a more steady progression of symptoms ("Multiple Sclerosis," n.d.).

The diagnosis of Multiple Sclerosis can be difficult because there is no singular test that confirms the presence of the disease. In an article by Chris Ratliff on the Multiple Sclerosis Foundation website, the author states that there are also a number of diseases with very similar symptoms to MS, such as muscular dystrophy, strokes and Lyme disease, which often times result in misdiagnosis in children and adults (2009). In order to diagnose the disease, it is important to study the distribution of the symptoms in the patient. It is also important to assess the pattern of symptoms, especially if there is evidence of the "relapsing-remitting" pattern. The first thing a doctor will likely do in diagnosing a patient with MS is to gather a detailed medical history and do a neurological exam. In addition to a medical history and a neurological exam, several lab tests are available to confirm or deny the presence of MS. An MRI can reveal plaques on the brain and spinal cord. These plaques, which look similar to the effects of small strokes, are caused by MS attacks. The MRI can distinguish between old and new plaques to demonstrate a "relapsing-remitting" pattern. A lumbar puncture, or spinal tap, can measure levels of immune proteins. These proteins are usually elevated in the cerebrospinal fluid of a person with MS. Finally, evoked potential tests, which are tests of electrical conduction speed in the nerves, can be done. These tests can show a doctor if a person has experienced demyelination ("Multiple Sclerosis," n.d.).

Multiple Sclerosis is an autoimmune disease, meaning that it is caused by an attack of the body's immune system. For unknown reasons, the immune cells attack the myelin sheaths of the brain and spinal cord. In spite of extensive research, the cause of the autoimmune attack is unknown. The risk of developing MS is higher if a

family member has suffered from the disease. This means that there is reason to believe that genetics play a part in the development of Multiple Sclerosis. Other factors may also play a role in the development of the disease. For instance, it is believed that a person may develop a slow virus, which over time leads to MS. Slow viruses are oftentimes known to lead to other debilitating diseases such as AIDS ("Multiple Sclerosis," n.d.).

The prognosis varies for each individual patient. Most people with MS will continue to walk and function at work or in their daily lives for many years after the initial onset of their disease. For children diagnosed with MS, the prognosis is more promising. Although there is no cure for the disease, the symptoms seem to progress more slowly in adolescents. Less than 5% of people with MS have a severe form, meaning that the disease will end in death from complications within five years. About 10-20% of patients have a benign form. This means that there is a very slow progression or no progression at all of symptoms. These people have a longer life expectancy. About 7 out of 10 people diagnosed with the benign form are still alive 25 years after their initial diagnosis. Most patients are expected to begin experiencing disabilities from their disease within 5 years of the initial onset ("Multiple Sclerosis," n.d.).

Physical Therapy and Occupational Therapy

In an article by Gehlsen, Grigsby and Winant, in the Journal of the American Physical Therapy Association, the authors note that since the etiological origin of MS

has yet to be determined, treatment is limited to the control of symptoms of MS through things such as therapy (653). Therapies for multiple sclerosis are aimed at preventing relapses in the disease, treating acute attacks and managing physical and cognitive symptoms of the disease. Physical therapy and occupational therapy can greatly decrease the physical symptoms of multiple sclerosis. Physical therapy is a profession that is concerned with the remediation of impairments and disabilities and the promotion of mobility, functional ability, quality of life and movement potential. Occupational therapy is a medical profession that is concerned with helping people to be able to complete daily tasks. Common interventions include helping children with disabilities to participate fully in school and helping people recovering from an injury to regain normal skills (Springer, 2011). In children, the onset of symptoms varies greatly from case to case. For many young children diagnosed with the disease, the interval between the first attack of demyelination and the second is much greater than adolescent and adult patients. In a multinational study of 137 children with MS, 13% of children with MS showed fixed neurological deficits that limited their ambulation after a mean disease duration of 5 years ("Multiple Sclerosis in Children," 2009). Although physical disability may occur relatively infrequently in the first decade in pediatric-onset, cognitive impairment may be significant. Physical therapy and occupational therapy aim to help with ambulation, performing daily tasks, keeping cognitive abilities at a normal level and decreased pain level from the disease ("Multiple Sclerosis in Children," 2009). In an interview with a pediatric physical therapy assistant at Riley Children's

Hospital, PTA Lori Kwitny stated that children with MS are treated similarly to adults with the disease:

> We treat children with MS the same way you would treat an adult. As a physical therapist, my goal is to keep the child moving during their stay in the hospital. Even a few days of complete bed rest can greatly aggravate the affects of the disease. Kids can develop bedsores, weak muscles and decreased muscle tone. Since the disease is already making the child fatigue easily and movement difficult, they can't be allowed to lose energy and muscle mass (Kwitny).

Children need to stay active throughout the course of their disease. Living an inactive life is never healthy, but for children with MS it is even more likely to cause health problems. The main difference between treating children and adults who are staying in the hospital for treatment of the disease is that children are more likely to need creative ways of treatment. For instance, a child will be bored with walking around in a hospital hallway for exercise and balance. Kicking a ball back and forth with someone is a good way to practice balance and to keep the child moving. Another good form of exercise for children is weight-bearing exercise. For people with Multiple Sclerosis, the risk of developing osteoporosis is high. This is because corticosteroids taken during treatment of the disease can cause a lowered calcium level and the levels of vitamin D, which is important for bone strength, tend to be low in MS patients. Weight-bearing exercise can help to improve bone strength and increase bone mass ("Multiple Sclerosis: Why Exercise?," 2013). However, it is

important to be careful with children because weight lifting can cause injuries to the joints and bones if not performed correctly. Low weight amounts such as 5-20 pounds can be plenty for treatment purposes ("Multiple Sclerosis: Why Exercise?," 2013). Another form of therapy used in conjunction with PT for children with Multiple Sclerosis is aquatic therapy. Aquatic therapy is physical therapy done in water to decrease the pressure on joints and bones that patients experience in normal physical therapy sessions ("Aquatic Therapy," 2013). In the article by Gehlsen and colleagues, some of the benefits of aquatic therapy are listed:

> Certain physical activities, such as jogging, may be inappropriate for patients with MS because of exposure to harsh environmental conditions and the requirement for stamina and balance beyond the patients' capacities. The buoyant nature of water and the ability to control water temperature effectively, however, are characteristics that have made a positive therapeutic response in patients with neuromuscular disease possible (653).

Aquatic therapy is something that many therapists use for patients who are weak or unable to bear a lot of weight. It can be done in replacement of weight lifting, running and other cardiovascular exercise for those patients who are too ill or weak to participate in a normal therapy session. In regards to treatment solutions, it is important that there is continued research to find different ways to help specifically children cope with symptoms of the disease.

Alternative Therapies

Alternative therapy is a title given to any form of medical intervention or treatment for a disease, which has not been scientifically documented as a safe or effective way of treating a disease. Alternative therapy includes approaches such as new diet and exercise programs as well as acupuncture, yoga, relaxation methods, herbal remedies and massage therapies. Since no cure has been discovered for Multiple Sclerosis, many patients opt to take part in alternative therapies. These therapies are normally compounded with physical therapy, occupational therapy and medicinal treatment. A main problem that people suffering from MS encounter is a loss of energy. Exercise such as tai chi or yoga can help to lower stress, improve relaxation abilities, and increase energy, balance and flexibility. In a research study performed by Birdee and colleagues for PMC US National Library of Medicine National Institutes of Health, the results suggested that there are many physical benefits to yoga for pediatric therapy such as improved posture, breathing and reduced stress. Although the study found no adverse side affects in any cohort groups, it is important to note that there is not enough conclusive research to prove that yoga is completely safe for pediatric use, thus making it a good alternative therapy versus traditional therapy (Birdee, Yeh, Wayne, Phillips, Davis, Gardiner 2009). Another alternative therapy is massage therapy. Massages can help patients to relax and reduce stress and depression, which can exacerbate the disease if left untreated. Although massage therapy has not been proven to change the course of the disease, it has been shown to help people cope with the symptoms of MS. Sometimes patients develop osteoporosis as a result of medicinal treatment for MS.

In this case, it would be unsafe for patients to partake in massage treatments. Acupuncture is a form of therapy that many people utilize when diagnosed with Multiple Sclerosis. Some benefits of acupuncture include pain relief, decreased muscle spasms, and improved bladder control. As with any alternative treatment, acupuncture does have risks associated with it. The main risk is infection due to needle use. It is important to make sure that sterile methods are used when receiving acupuncture treatment ("Alternative Therapy," 2013).

Medicinal Therapies

Choice of medication should be based upon discussions with the child and parents focusing on compliance, efficacy and tolerability. Simply put, the child and his family must pick a medication track based upon the child's ability to tolerate the treatment, the parents' ability to administer the medication or take the child to a location that will administer treatments, and the family's willingness to participate in treatment. If a family is not willing to give the child medication three times a day, they should pick a more easily maintained treatment course. The initial drug therapy is often administered at 25-50% of the recommended adult dosage. This is followed by a stepwise escalation of drug amount every 2-4 weeks until the dosage is at its highest amount. Use of acetaminophen or ibuprofen at the time of injections will lessen the frequency and severity of reactions to the treatment during the first few months of therapy ("Multiple Sclerosis in Children," 2009).

There are many types of drugs that patients with pediatric Multiple Sclerosis can use for symptom alleviation and life prolonging. The first is Betaseron or Betaferon. Given the variable size and weight of children, specialists initiate therapy with Betaferon at one quarter of the adult dose. The dosage is increased incrementally monthly by a quarter dose provided that the child tolerates the treatment. The most common adverse side effects of this particular drug include flu-like symptoms, abnormal liver function and injection site reactions ("Multiple Sclerosis in Children," 2009). The second type of drug available is Avonex. Those who have taken Avonex have experienced reduced risk of disability progression, experienced fewer exacerbations of their disease and showed a reduction in number and size of lesions in the brain. Adverse side effects include fever, injection site soreness, flu-like symptoms and headaches ("Multiple Sclerosis in Children," 2009). A third option for drug therapy is Copaxone. The drug is administered at the daily dose of 20 mg daily for 24 months. It has been known to decrease the side effects of MS. Some adverse effects include facial flushing and fast heart rate ("Multiple Sclerosis in Children," 2009). A final type of drug therapy is immunosuppressive therapy. This is a therapy that is received orally. It has been used in MS to prevent exacerbations of the disease. Side effects include gastrointestinal intolerance, liver toxicity and skin rashes ("Multiple Sclerosis in Children," 2009). Drug therapy can be an effective way to treat the symptoms of MS, thus making the disease more tolerable for patients. However, medication can be expensive, and patients may experience many adverse side effects such as flu-like symptoms, headaches, injection site soreness and more ("Multiple Sclerosis in Children," 2009).

Conclusion

Although Multiple Sclerosis is more common in adults, it does appear in children about 2-5% of the time. This disease is one that cannot be cured, and is very detrimental to the nervous system. When a person develops MS, lesions are formed on the myelin sheath of neurons. These lesions are irreversible, and they can lead to serious health problems such as physical impairments, fatigue, seizures and eventually, death. Although Multiple Sclerosis is a terrible disease, there are many therapies used to alleviate the symptoms. Physical and occupational therapy help sufferers of MS to stay active and healthy through exercise and rehabilitation. Alternative therapies like yoga and acupuncture can help to alleviate stress and pain that come with the disease. Finally, medicinal therapies allow patients to prolong the effects of their disease and help to make the symptoms more bearable. As of now, treatments for Multiple Sclerosis only help to make the disease more bearable. However, research is being done to help find a cure. Hopefully in time, a cure will be found and patients will survive the terrible disease.

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